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Clean Air Agency

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Cleaner air for tomorrow, today

Climate Change & Transportation

Dennis McLerran, Executive Director
Puget Sound Clean Air Agency
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Presentation Overview

- Transportation & the Emission Inventory
- Climate Impacts on Transportation
- Mitigation and Adaptation
- Climate Change Opportunities and Transportation
- Conclusion

Transportation & the Emission Inventory

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- Transportation contributes over half of Washington's greenhouse gas emissions
- Approximately 90 million vehicle miles traveled daily in Puget Sound
- Rapidly growing fuel use in ports and goods transport
- National inventory is dominated by fossil fuel power emissions with transportation following

Regional Greenhouse Gas Emission Sources

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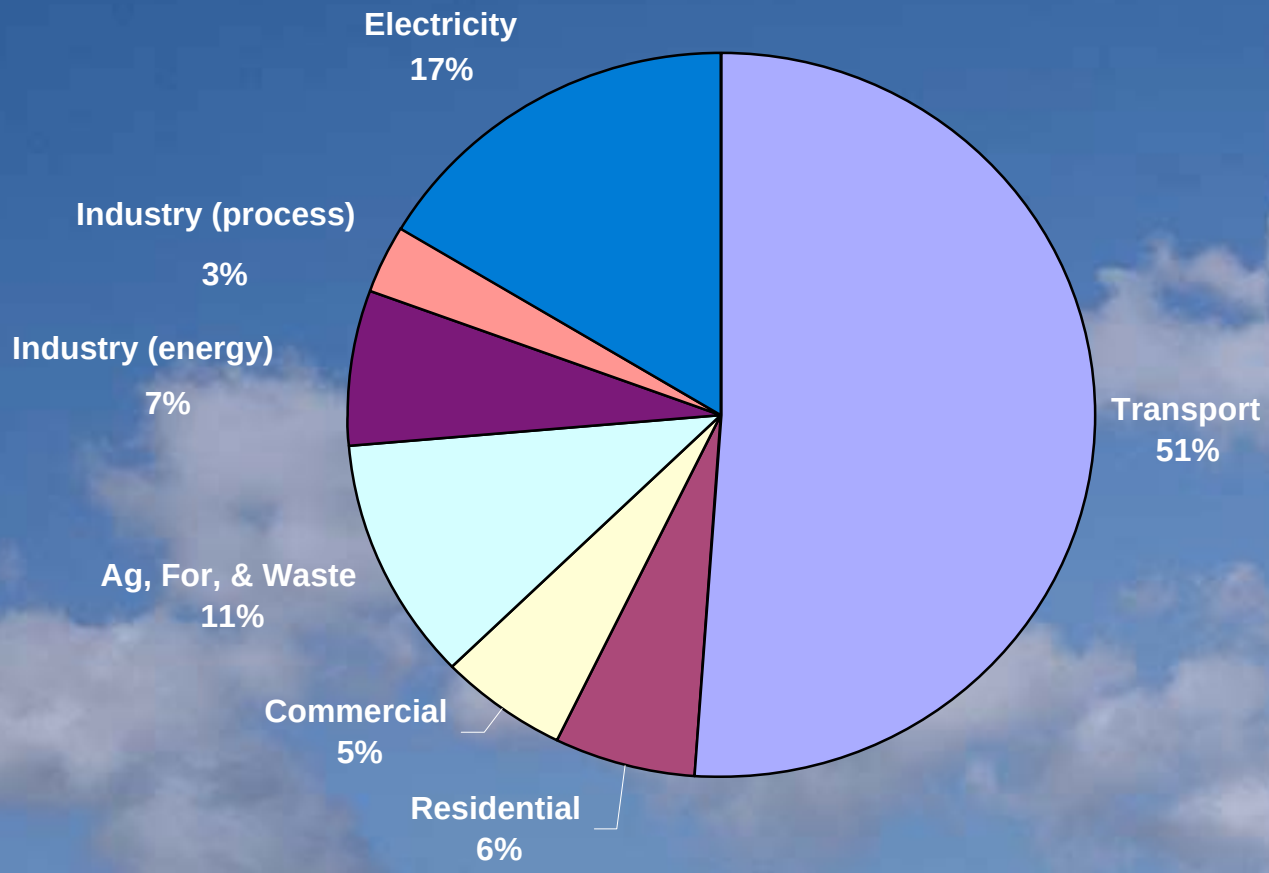
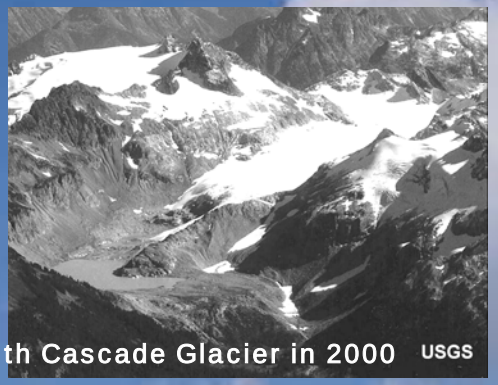
2002 Greenhouse Gas Emissions for the Puget Sound Region



Washington Climate Impacts

- Reduced snowpack
  - Water supply impacts
  - Habitat impacts
  - Energy supply impacts
- Rising sea levels
- Increased streamflows and storm water runoff

South Cascade Glacier in 1928 USGS



South Cascade Glacier in 2000 USGS

Adaptation and Mitigation

- Adaptation: adjusting to a changing climate
- Mitigation: reducing human impacts on the climate
- Scientists believe that we have already emitted enough greenhouse gases that we cannot avoid warming
- Scientists estimate a 70+ percent reduction in current emissions is needed to stabilize the climate

Adapting Transportation Planning for a Changing Climate

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- Higher sea levels combined with land subsidence require new thinking about seawalls, storm drainage and roadway elevations
- More intense rainfall requires different storm drainage design
- Snow removal may diminish at lower elevations but increase at higher elevations

Mitigating Transportation Impacts

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- Reducing CO2 from fuel use is an imperative
  - Increase vehicle efficiency
    - ▲ California greenhouse gas standards
    - ▲ Higher Corporate Average Fuel Economy (CAFE) standards
  - Alternate fuels
    - ▲ Biodiesel
    - ▲ E85 for conventional vehicles
    - ▲ Cellulosic ethanol
  - Increased emphasis on non-SOV options: transit, light rail, walking and bicycling
  - Mode shifts as people look for more efficiency
- Fuel will cost more and revenue from fuel taxes will decline or level off
  - Efficiency will become a primary goal
  - Costs, competitiveness, science and politics will drive efficiency

Transportation Opportunities

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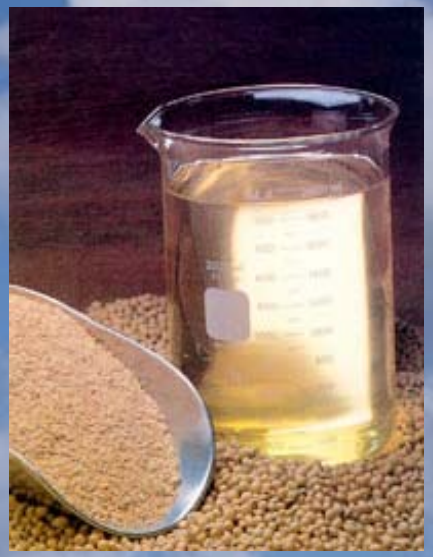
- More efficient vehicles
  - Washington clean car standards
  - Diesel vehicles
  - Clean fuels
  - Hybrid transit buses
- Electrification of transportation
  - Plug-in hybrids and electric vehicles
  - Truck stop electrification and Smart Way Transport Kits
  - Cruise ship and port electrification
  - Infrastructure challenges
  - Hydrogen?
- More efficient construction
  - Ground Granulated Blast Furnace Slag Cement
  - Alternative fuels for construction equipment
- Diesel soot reduction



Washington Clean Car Standards

- Effective for 2009 model year
- Include California greenhouse gas standards
  - 3% CO2 fleet reduction in 2009 phasing up to 30% reduction by 2017
  - CO2 reductions based on technology changes without hybrids
  - Unfortunately, growth in number of vehicles and VMT will offset vehicle reductions
- Will mean a much cleaner fleet overall – indicative of collateral benefits often available with CO2 reductions

Near-Term Technologies

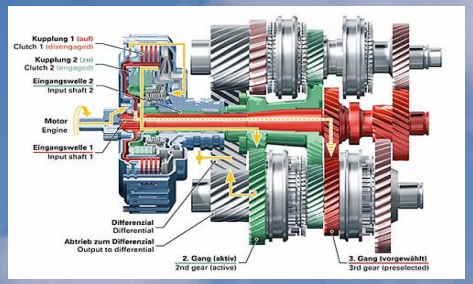
- Available technologies that could be widely used by 2012
  - 6 speed automatic and automated manual transmissions
  - Electric power steering
  - Cylinder deactivation
  - Variable valve timing & lift
  - Gasoline direct injection
  - Turbocharging
  - Improved alternator
  - More efficient, low-leak air conditioning

Near-Term Technologies

Cylinder Deactivation

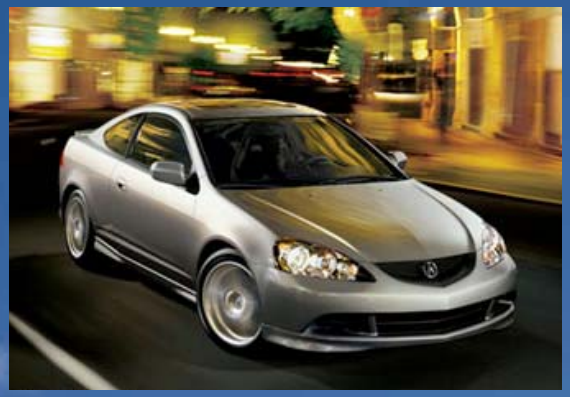
2005 Chrysler 300C Hemi

Audi TT
3.2 V6



Automated Manual Transmission
Audi TT

Near-Term Technologies



Acura RSX

Variable valve timing & lift

Honda Accord

Toyota Matrix

Near-Term Technologies

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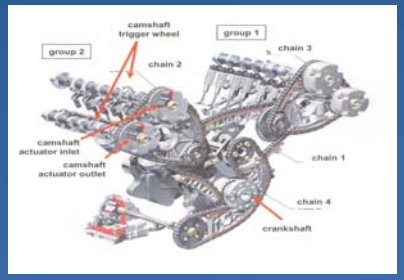
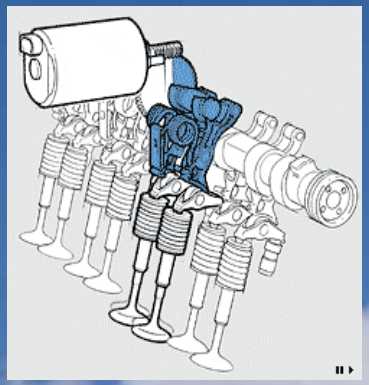
Gasoline Direct Injection w/dual cam phasers



Audi

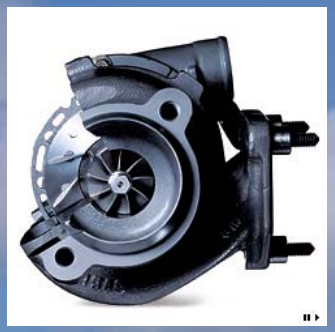
2005 Audi A4



BMW Valvetronic (continuously variable valve timing & lift)

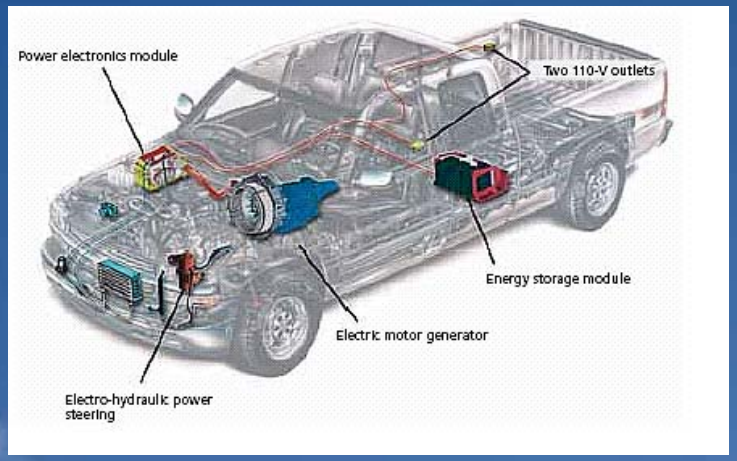
BMW 5 Series

Volvo S60



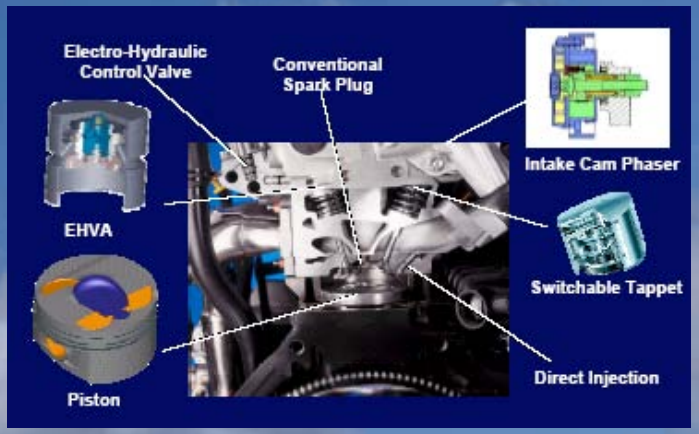
Turbocharger

Mid-Term Technologies

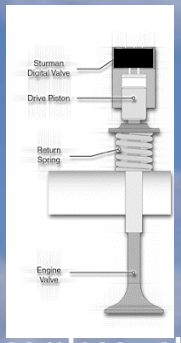


Integrated Starter/Generator

2005 Chevrolet Silverado



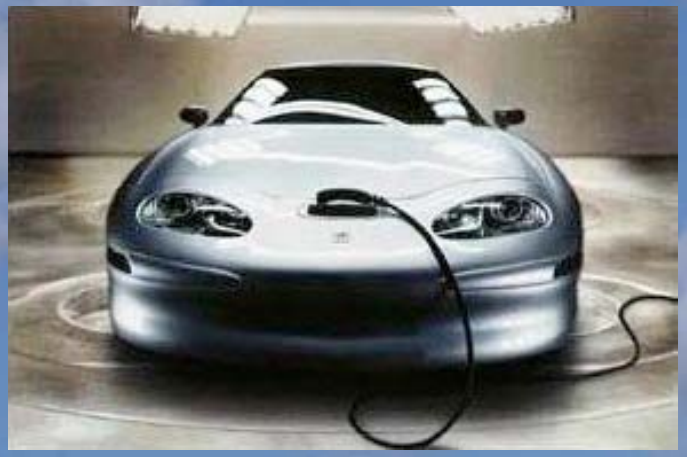
AVL Homogeneous Combustion Compression Ignition



Sturman camless valve actuation

Electrification of Transportation

- Plug-in electric hybrid vehicles
- Port electrification
- Pure electric vehicles with lithium ion batteries may have many applications from short-range support vehicles to cargo-handling equipment
- Requires careful study of the impacts on the grid and on infrastructure



Plug-in Hybrids

- Toyota, Ford, Chrysler and GM have all shown interest
- Require breakthroughs in lithium ion batteries
- May be on market in 2 to 5 years
- Austin Energy, Calcars and others have developed soft orders and prototypes

Reductions from Exhaust Retrofits

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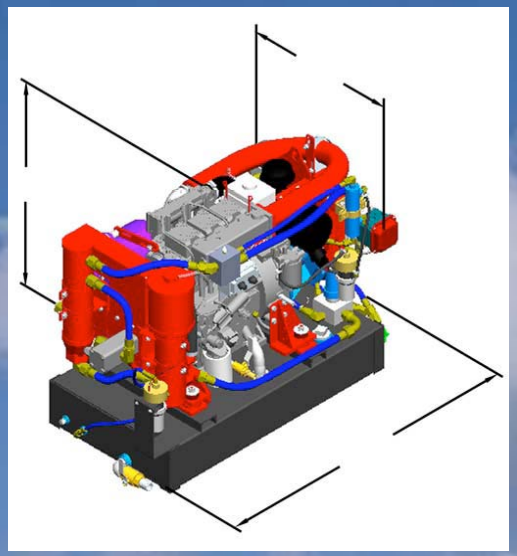
- Oxidation catalyst, non-road diesel
  - Up to 30% fine particles
  - 50% toxics & hydrocarbons
- Oxidation catalyst with ultra low sulfur diesel fuel (ULSD)
  - Up to 40% fine particles
  - 70% toxics & hydrocarbons
- Catalyzed particle filter, ULSD
  - 90-95% fine particles,
  - Toxics & hydrocarbons
- Crankcase filter systems
  - 10% fine particles

Beyond Retrofits: Clean Locomotive Technology

- **Allows an idling locomotive to be shut-down by heating the engine coolant and oil, charging the batteries and powering the cab heaters**
- **Reduces fuel consumption, oil consumption, emissions, noise, and engine wear**



Beyond Retrofits: Marine Vessel Shore Power

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Beyond Retrofits: Marine Vessel Seawater Scrubbing

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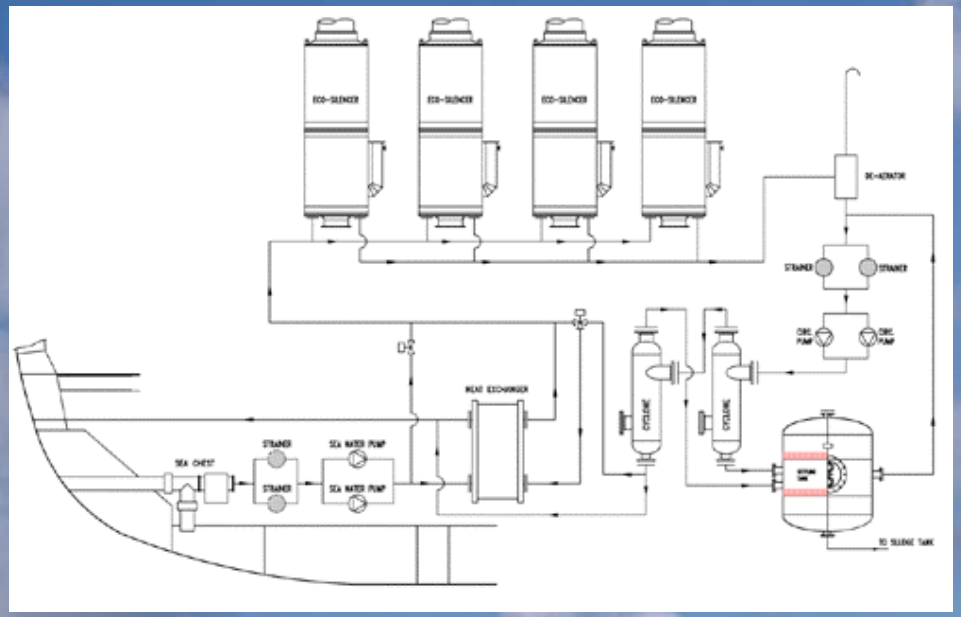
- Hot exhaust gas mixes in a turbulent cascade with seawater. Sufficient contact between gas and water absorbs pollutants.
- Acidic gases, and particulate removed from the exhaust gas, pass through a water treatment system designed to filter wastes on a continuous basis.



Beyond Retrofits: EPA's Smart Way For On-road Trucks

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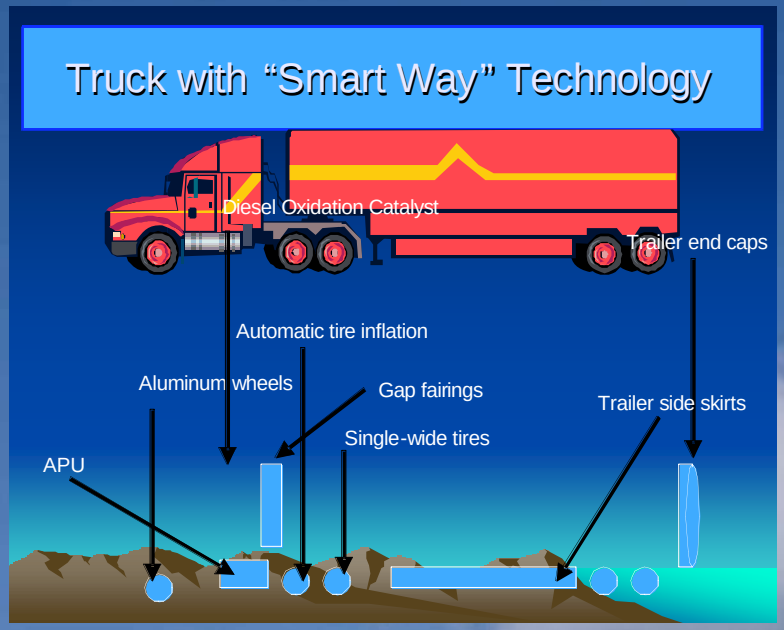
- Technologies
  - Exhaust treatments
  - Idle reduction
    - ▲ APUs, shore power, thermal storage, battery packs and more
  - Fuel saving
    - ▲ Increased aerodynamics, decreased rolling resistance, reduced weight



- Driver education
- Improved freight logistics
- Low cost loans for technology purchases
- Smart Way in other states – MN, AR, OR, CA

Beyond Retrofits: Truck Stop Electrification

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- **Shore Power Systems**
  - Plug into grid to operate HVAC and other cab appliances
  - Must have on-board OEM or retrofitted equipment
  - Cheaper to install and more energy efficient

- **Advanced Truck Stop Electrification**
  - System does not require on-board OEM or retrofitted equipment except a window template
  - HVAC system supplied to truck through duct
  - Expensive to install (3 to 6 times Shore power)
  - Uses twice as much grid power as shore power systems

Conclusion

- Climate change presents both challenges and opportunities for transportation
- In Washington State, transportation has added importance as it is a higher percentage of CO2 emissions
- More efficient and cleaner transportation options will be demanded by the public and the political climate
- Transportation infrastructure will have to be adapted to a changing climate